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DOCUMENT CLASSIFICATION BARCODE SHEET



371 Application As-Filed

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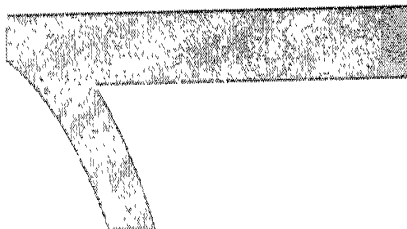


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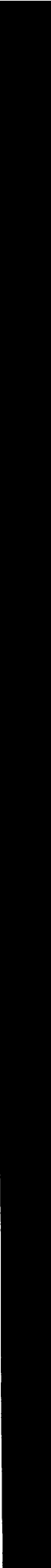
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Transmittal



Level - 2
Version 1.1
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U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE
FORM PTO-1390 (REV. 11-2000)

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MAR 05 2002

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER

5183/US/PCT/BG

U.S. APPLICATION NO. (if known, see 37 CFR 1.5

10/070330

INTERNATIONAL APPLICATION NO. INTERNATIONAL FILING DATE

PCT/US01/41237 30 June 2001 (30.06.01)

PRIORITY DATE CLAIMED

07 July 2000 (7.07.00)

TITLE OF INVENTION AUTOMATIC DOOR OPENER

APPLICANT(S) FOR DO/EO/US William Tyler Weaver

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☐ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:

Return Postcards
Recordation Form Cover Sheet (Form PTO-1595)

U.S. APPLICATION NO. 107070330 INTERNATIONAL APPLICATION NO. PCT/US01/41237

ATTORNEY'S DOCKET NUMBER
5183/US/PCT/BG

CALCULATIONS PTO USE ONLY

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1000.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$990.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)). ☐ 20 ☐ 30

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	16	0	x \$18.00
Independent claims	3	0	x \$80.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00

TOTAL OF ABOVE CALCULATIONS =

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +

SUBTOTAL =

Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)). ☐ 20 ☐ 30

TOTAL NATIONAL FEE =

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

TOTAL FEES ENCLOSED =

\$ 890.00

\$ 0.00

\$ 0.00

\$ 0.00

\$ 0.00

\$ 890.00

\$ 40.00

\$ 930.00

Amount to be refunded: \$

charged: \$

- a. ☒ A check in the amount of \$ 930.00 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 04-1696. A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

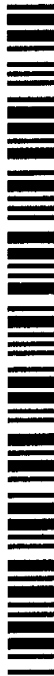
Valerie G. Dugan
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SIGNATURE
Valerie G. Dugan 3/5/02

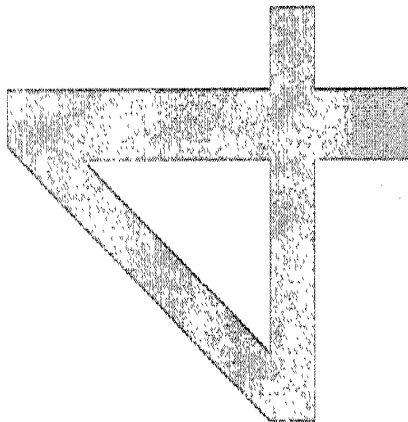
NAME
Valerie G. Dugan

REGISTRATION NUMBER
36,125

UNITED STATES PATENT AND TRADEMARK OFFICE
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Specification



Level - 2
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104070330

AUTOMATIC DOOR OPENER

This application claims priority from U.S.

5 Provisional Patent Application Serial No. 60/217,147, filed
July 7, 2000, which is hereby incorporated by reference
herein in its entirety.

FIELD OF THE INVENTION

10 The invention relates generally to fabrication
systems and more particularly to an apparatus and method for
opening a door portion of a wafer carrier.

BACKGROUND OF THE INVENTION

15 Conventional semiconductor fabrication systems
transport a plurality of wafers in a sealed wafer carrier
such as a sealed container or pod, thereby maintaining the
wafers in a clean/controlled environment. Thus,
20 conventional processing systems include a plurality of wafer
carrier loading stations where the sealed pods are opened,
wafers are extracted therefrom and are loaded into the
processing system. Each wafer carrier loading station
comprises a wafer carrier platform adapted to receive a
sealed pod, which contains a cassette of wafers, and a wafer
25 carrier opener adapted to engage and unlatch a door portion
of the pod (hereinafter a pod door).

In operation, the wafer carrier platform receives
a pod and moves the pod horizontally toward the wafer
carrier opener. Thereafter, the wafer carrier opener
engages and unlatches the pod door. A first actuator moves
30 the pod door horizontally away from the wafer carrier
platform, and then a second actuator moves the pod door
vertically downward to provide clear access to the wafers in
the pod. Hence, the wafer carrier opener requires the use

of two separate actuators, which increases equipment expense.

Accordingly, there is a need for an improved wafer carrier opener having a pod door that moves both vertically and horizontally while using only a single actuator, thus satisfying the ever-present demand for reduced cost per unit wafer processed.

SUMMARY OF THE INVENTION

10 The inventive wafer carrier opener may eliminate
the use of two separate actuators by using a linkage
mechanism. The inventive wafer carrier opener comprises a
wafer carrier door receiver, adapted to receive a wafer
carrier door, a horizontally stationary member, and a link
15 coupled between the wafer carrier door receiver and the
horizontally stationary member so as to allow horizontal
movement of the wafer carrier door receiver.

A method of opening a sealed wafer carrier, the method comprising: elevating a wafer carrier door receiver assembly; impacting a vertical motion stop with a portion of the wafer carrier door receiver assembly thereby limiting the vertical motion of a portion of the wafer carrier door receiver assembly; continuing elevating a remaining portion of the wafer carrier door receiver assembly; and translating the continued elevation of the remaining portion of the wafer carrier door receiver assembly into horizontal motion of at least a door receiving portion of the vertically limited portion of the wafer carrier door receiver assembly.

Other features and advantages of the present invention will become more fully apparent from the following detailed description of the preferred embodiments, the appended claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a schematic top plan view, in pertinent part, of a processing system having a factory interface wafer handler adapted to transport wafers between a plurality of wafer carrier loading stations and a processing tool;

FIG. 2A is a schematic side view of the wafer carrier loading station of FIG. 1, having the conventional wafer carrier opener;

FIG. 2B is a side cross-sectional view of the conventional wafer carrier opener of FIG. 2A;

FIGS. 3A-D are sequential side views of a first embodiment of an inventive wafer carrier opener;

FIG. 4 is a perspective side view of the inventive wafer carrier opener of FIGS. 3A-D;

FIGS. 5A-C are side views of a second embodiment of the inventive wafer carrier opener; and

FIG. 6 is a perspective side view of the second embodiment of the inventive wafer carrier opener with a horizontally stationary member in an alternative position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 is a schematic top plan view, in pertinent part, of a processing system 11 having a factory interface wafer handler 13 adapted to transport wafers between a plurality of wafer carrier loading stations 15a-d and a processing tool 17. The exemplary processing system 11 shown in FIG. 1 includes an interface chamber 19 and the processing tool 17 which, in this example, comprises a pair of loadlock chambers 23, a transfer chamber 25 coupled to the loadlock chambers 23, and a plurality of processing chambers 27 coupled to the transfer chamber 25.

An interface wall 29 is positioned between the wafer carrier loading stations 15a-d and the processing system 11 for separating a "white area" clean room 31 from a less clean, "gray area" clean room 33. The wafer carrier loading stations 15a-d are located in the "white area" clean room 31 and the processing system 11 is located in the less clean, "gray area" clean room 33. The wafer carrier loading stations 15a-d are positioned adjacent sealable openings 35 in the interface wall 29. The wafer carrier loading stations 15a-d comprise a wafer carrier platform (not shown) adapted to receive a sealed pod (not shown) and a conventional wafer carrier opener 37 adapted to engage and unlatched a pod door from the remainder of the pod as is known in the art.

The interface chamber 19 contains the interface wafer handler 13 mounted to a track T (not shown). The transfer chamber 25 of the processing tool 17 contains a transfer wafer handler 39 adapted to transport wafers (not shown) between the loadlock chambers 23 and the processing chambers 27.

In operation, a pod, containing cassettes of wafers, is loaded onto the wafer carrier loading station 15. The conventional wafer carrier opener 37 engages and unlatches the pod door. With the use of two separate actuators (not shown), the conventional wafer carrier opener 37 moves the pod door horizontally away from the wafer carrier platform and then moves the pod door vertically downward to provide clear access to the wafers in the pod. The interface wafer handler 13 of the interface chamber 19 then extracts a wafer from the pod and transports the wafer to one of the loadlock chambers 23. Thereafter, the transfer wafer handler 39 of the processing tool 17 transports the wafer from the loadlock chamber 23 to a

The actuator 57 then activates the pod door key actuating mechanism 53, which in turn rotates the key 55 to unlatch the pod door latches (not shown). Once the pod door latches are unlatched, the pod door 45 is unlocked from the remainder of the pod 43.

Thereafter, the conventional wafer carrier opener 37 having the pod door 45 now attached thereto moves the pod door 45 horizontally, via a horizontal actuator (e.g., a first actuator not shown), in a direction away from the wafer carrier platform 41, as indicated by arrow A. A vertical actuator (e.g. a second actuator not shown) then moves the pod door 45 vertically downward, as indicated by arrow B, until the pod door 45 clears the opening in the interface wall 29 to provide access to the wafers or cassette in the pod 43 by a wafer handler 13 within the interface chamber 19. As described above, the conventional wafer carrier opener 37 requires the use of two separate actuators in order to open and/or close a sealed wafer carrier.

Accordingly, the present inventor has provided an improved wafer carrier opener that employs a single actuator to achieve both the vertical and horizontal pod door movement.

The components of a first embodiment of an inventive wafer carrier opener 101a are described with reference to FIGS. 3A-4. FIGS. 3A-D are sequential side views of the inventive wafer carrier opener 101a, and FIG. 4 is a perspective side view of the inventive wafer carrier opener 101a. Except for the two actuators (a horizontal actuator, and a vertical actuator) the inventive wafer carrier opener 101a may comprise the same components as the conventional wafer carrier opener 37 of FIG. 2B. The conventional components of the inventive wafer carrier

stationary member 107 as shown in FIG. 4. Also as shown in FIG. 4, an additional link 109 may be included if desired.

The cam follower 123 comprises a vertical extension 127 and a horizontal extension 129. The vertical extension 127 of the cam follower 123 is coupled to the wafer carrier door receiver 103, (in this example via the second joint 121 of the lower link 113), so that the cam follower 123 moves horizontally with the wafer carrier door receiver 103. The horizontal extension 129 is adapted so as to contact a vertical motion stop (e.g., a cam 131) as the inventive wafer carrier opener 101a moves vertically upward, thereby stopping further vertical motion of the cam follower 123.

The cam 131 is positioned adjacent the cam follower 123 and between the horizontal extension 129 and the wafer carrier door receiver 103 as shown in FIGS. 3A-C. Specifically, the cam 131 is positioned such that when the horizontal extension 129 of the cam follower 123 contacts the cam 131, the wafer carrier door receiver 103 is in position to engage (e.g., at the same elevation as) the pod door 45, located on the wafer carrier platform 41. Hence, the cam 131 and the wafer carrier platform 41 may serve as datum points to provide accurate alignment of the inventive wafer carrier opener 101a so as to properly position the wafer carrier door receiver 103 relative to the pod door 45.

The inventive wafer carrier opener 101a may also include a counterbalancing mechanism adapted to bias the wafer carrier door receiver 103 upwardly. The counterbalancing mechanism may be coupled to the horizontally stationary member 107 and to the wafer carrier door receiver 103. For example, the counterbalancing mechanism may comprise an extension 135 of the horizontally stationary member 107 that extends above the elevation of

the wafer carrier door receiver 103, and a biasing mechanism 137 coupled between the extension 135 and the wafer carrier door receiver 103 as shown in FIGS. 3A-C. The biasing mechanism 137 may comprise a spring, a cylinder, a counterweight, or any mechanism that may bias the wafer carrier door receiver 103 upwardly so as to resist the gravitational force that otherwise may move the wafer carrier door receiver 103 vertically downward.

A vertical actuator such 139 is adapted to vertically move the inventive wafer carrier opener 101a upwardly, so as to place the wafer carrier door receiver 103 in position to engage the pod door 45. The actuator 139 also is adapted to vertically move the inventive wafer carrier opener 101a downward so as to expose an opening 35 (FIG. 1) in the interface wall 29, thereby allowing access to the wafers in the pod 43.

The operation of the inventive wafer carrier opener 101a is described with reference to the sequential views of FIGS. 3A-D, which show the movement of the inventive wafer carrier opener 101a. The upper link 111 and the lower link 113 are initially in a retracted (e.g. horizontal) position as shown in FIG. 3A.

In operation, the actuator 139, which is coupled to the horizontally stationary member 107, is energized and moves the horizontally stationary member 107 vertically upward, carrying the cam follower 123, and the wafer carrier door receiver 103 therewith. As the inventive wafer carrier opener 101a moves vertically upward, the horizontal extension 129 of the cam follower 123 contacts the cam 131 so as to prevent the cam follower 123 from further upward movement. The wafer carrier door receiver 103 also is prevented from moving vertically upward because the vertical extension 127 of the cam follower 123 is coupled to the

wafer carrier door receiver 103, via the second joint 121 of the lower link 113. When the horizontal extension 129 of the cam follower 123 contacts the cam 131, the wafer carrier door receiver 103 is in position to engage (e.g. is at the same elevation as) the pod door 45, located on the wafer carrier platform 41.

The horizontally stationary member 107 and the counterbalancing mechanism continue to move vertically upward relative to the cam follower 123 and the wafer carrier door receiver 103, which remain at the elevation of the pod door 45. As the horizontally stationary member 107 moves vertically upward relative to the cam follower 123 and the wafer door receiver 103, the first joints 115, 119 of the upper link 111 and the lower link 113 move upward. As the member 107 is restrained horizontally, this vertical motion positions the upper link 111 and the lower link 113 in an extended position (e.g. a position that is more horizontal than is the retracted position) as shown in FIG. 3B, thereby extending the wafer carrier door receiver 103 horizontally.

As the upper link 111 and the lower link 113 move to the extended position, the cam follower 123 and the wafer carrier door receiver 103 move horizontally toward the interface wall 29 (e.g. the links 111, 113 leverage off of the horizontally stationary member 107). In the exemplary embodiment shown the wafer carrier door receiver 103 moves in a straight horizontal line, due to the horizontally straight configuration of the horizontal extension 129 and the vertical fixation thereof when engaged with cam 131. As the wafer carrier door receiver 103 moves horizontally toward the interface wall 29, the horizontally stationary member 107 and the extension 133 move vertically upward, the biasing mechanism 137 also biases the wafer carrier door

receiver 103 upwardly (thus resisting the gravitational force that otherwise may move the wafer carrier door receiver 103 vertically downward and pulling the upper and lower links 111, 113 into the retracted position).

At the interface wall 29, the wafer carrier door receiver 103 of the inventive wafer carrier opener 101a couples to and unlatches the pod door 45, as is conventionally known. Once the door 45 is opened, the actuator 139 reverses direction, and the horizontally stationary member 107 and the extension 133 (having the door attached thereto via the wafer carrier door receiver 103) begin moving vertically downward. As the horizontally stationary member 107 moves vertically downward, the first joints 115, 119 of the upper link 111 and the lower link 113 move downward. Because the position of first joints 115, 119 is horizontally fixed with respect to the wall 29 of the interface chamber 19, vertical motion of the joints 115, 119 enables the bar 129 to move to a position below the cam 131 in which the bar 129 no longer contacts the cam 131, thereby enabling biasing member 137 to retract and move the inner links 117, 121 upward and away from the pod 43 to retract the door 45 therefrom. Specifically, in this example, the biasing mechanism 137 is sufficiently stiff so as to continually upwardly bias the wafer carrier door receiver 103 (with or without the added weight of the door 45). Thus, when the bar 129 no longer contacts the cam 131 (which contact prevents the wafer carrier door receiver 103 from moving upward in response to the upward bias applied by the biasing mechanism 137), the biasing mechanism 137 causes the wafer carrier door receiver 103 to retract away from the pod 43, as described above.

As the upper link 111 and lower link 113 move to the retracted position, the cam follower 123 and the wafer

carrier door receiver 103, with the pod door 45 attached thereto, move horizontally in a straight line (e.g., following the straight surface of the bar 129) away from the interface wall 29. The inventive wafer carrier opener 101a continues to move vertically downward so as to provide an opening in the interface wall 29, thereby allowing access to the wafers in the pod 43 as shown in FIG. 3D. Accordingly, as described above, the inventive wafer carrier opener 101a may move both vertically and horizontally with use of a single actuator.

FIGS. 5A-C are side views of a second embodiment 101b of the inventive wafer carrier opener. The inventive wafer carrier opener 101b may comprise the same components as the inventive wafer carrier opener 101a of FIGS. 3A-4. In this embodiment, however, the wafer carrier door receiver 103 has been configured to include a paddle 141, coupled to the horizontally stationary member 107, via the link 109.

The horizontally stationary member 107 is positioned on the wafer carrier side of the paddle 141 as shown in FIGS. 5A-C. Alternatively, as shown in FIG. 6, which is a perspective side view of the inventive wafer carrier opener 101b, the horizontally stationary member 107 may be positioned on the non-wafer carrier side of the paddle 141. Thus, the horizontally stationary member 107 may be positioned on either side of the paddle 141. Also, although the upper link 111 and the lower link 113 are positioned toward the bottom of the paddle 141 as shown in FIGS. 5A-C, the upper link 111 and the lower link 113 may be positioned at any location along the paddle 141.

The operation of the inventive wafer carrier opener 101b is substantially identical to that described above, and is now described with reference to the sequential views of FIGS. 5A-C, which show the movement of the

As the upper link 111 and the lower link 113 move to the retracted position, the cam follower 123 and the wafer carrier door receiver 103 coupled thereto move horizontally in a straight line (e.g., due to the horizontally straight configuration of the horizontal extension 129 and the vertical fixation thereof when engaged with the cam 131) toward the interface wall 29 (FIG. 2) as shown in FIG. 5B. As the wafer carrier door receiver 103 moves horizontally toward the interface wall 29, and as the counterbalancing mechanism moves vertically upward, the biasing mechanism 137 of the counterbalancing mechanism also biases the wafer carrier door receiver 103 upwardly (thus resisting the gravitational force that otherwise may move the wafer carrier door receiver 103 vertically downward and pulling the upper and lower links 111, 113 into the retracted position).

At the interface wall 29, the wafer carrier door receiver 103 of the inventive wafer carrier opener 101b couples to and unlatches the pod door 45, as is conventionally known. Once the pod door 45 is opened, the inventive wafer carrier opener 101b (having the pod door 45 attached thereto via the wafer carrier door receiver 103) moves vertically downward so as to provide an opening in the interface wall 29, thereby allowing access to the wafers in the pod 43 as shown in FIG. 5C.

As is evident from the description above, the inventive wafer carrier opener 101a, 101b may use a single actuator 139, which may result in increased equipment reliability, and reduced cost per unit wafer processed.

Further, the cam 131 provides a convenient datum point that allows the position of the wafer carrier door receiver 103 to be accurately controlled relative to the pod door 45. Additionally, the preferred straight-line motion

(e.g., which may result from the cam 131 following the straight surface of the bar 129) of the wafer carrier door receiver 103 may reduce particle generation that may otherwise occur when the wafer carrier door 103 contacts the pod door 45. However, a wafer carrier door receiver may move along an alternative path (e.g. along an arch path) toward the interface wall 29.

The foregoing description discloses only the preferred embodiments of the invention, modifications of the above-disclosed apparatus and method which fall within the scope of the invention will be readily apparent to those of ordinary skill in the art. For example, the cam follower 123 may be coupled to the second joints 117, 121 of both the upper link 111 and the lower link 113. The links 111, 113 may be similarly employed to translate horizontal actuation of a vertically stationary mechanism into vertical motion of a wafer carrier door receiver. In fact, the links 111, 113 may be employed to translate motion of a first direction into motion of a second direction, (in this example, perpendicular to the first direction). Thus, actuation need not be purely horizontal or purely vertical. Likewise, the horizontally (or vertically) stationary member may move horizontally (or vertically) so long as the member provides a repeatable horizontal (or vertical) position against which the links 111, 113 may leverage.

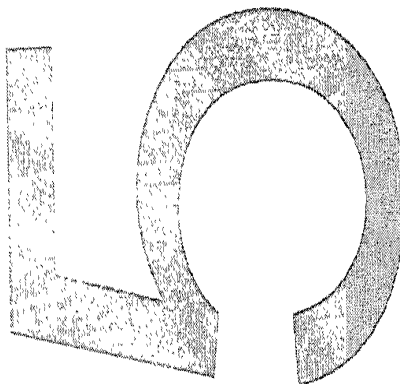
Accordingly, while the present invention has been disclosed in connection with the preferred embodiments thereof, it should be understood that there may be other embodiments which fall within the spirit and scope of the invention, as defined by the following claims.

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Claims



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WHAT IS CLAIMED IS:

1. A wafer carrier opener comprising:
a wafer carrier door receiver adapted to receive a wafer carrier door;
a horizontally stationary member; and
a link coupled between the wafer carrier door receiver and the horizontally stationary member so as to allow horizontal movement of the wafer carrier door receiver.
2. The wafer carrier opener of claim 1 wherein the link comprises a pair of links coupled between the wafer carrier door receiver and the horizontally stationary member such that the wafer carrier door receiver, the horizontally stationary member, and the pair of links form a four-bar link.
3. The wafer carrier opener of claim 2 further comprising a counterbalance coupled to the horizontally stationary member and to the wafer carrier door receiver, the counterbalance adapted to bias the wafer carrier door receiver upwardly.
4. The wafer carrier opener of claim 3 wherein the counterbalance comprises a spring.
5. The wafer carrier opener of claim 1 further comprising a vertical motion stop and a mechanism coupled to the horizontally stationary member so as to move vertically therewith, and coupled to the wafer carrier door receiver so as to move horizontally therewith, the mechanism adapted so as to contact the vertical motion stop and to thereby be stopped from further vertical motion.

6. The wafer carrier opener of claim 5 wherein the link comprises a pair of links coupled between the wafer carrier door receiver and the horizontally stationary member such that the wafer carrier door receiver, the horizontally stationary member, and the pair of links form a four-bar link.

7. The wafer carrier opener of claim 1 further comprising a counterbalance coupled to the horizontally stationary member and to the wafer carrier door receiver, the counterbalance adapted to bias the wafer carrier door receiver upwardly.

8. The wafer carrier opener of claim 7 further comprising a vertical motion stop and a mechanism coupled to the horizontally stationary member so as to move vertically therewith, and coupled to the wafer carrier door receiver so as to move horizontally therewith, the mechanism adapted so as to contact the vertical motion stop and to thereby be stopped from further vertical motion.

9. The wafer carrier opener of claim 8 wherein the counterbalance comprises a spring.

10. A wafer carrier opener comprising:
a wafer carrier door receiver adapted to receive a wafer carrier door;

a horizontally stationary member;
a cam follower, coupled to the horizontally stationary member so as to allow relative movement there between and fixedly coupled to the wafer carrier door receiver;

a stationary cam positioned so as to limit vertical motion of the cam follower;

a counterbalancing mechanism coupled to the horizontally stationary mechanism and to the wafer carrier door receiver and adapted to bias the wafer carrier door receiver upwardly;

an upper link, having a first joint and a second joint, wherein the first joint is coupled to the horizontally stationary member and the second joint is coupled to the wafer carrier door receiver so as to allow horizontal movement of the wafer carrier door receiver relative to the horizontally stationary member; and

a lower link, having a first joint and a second joint, wherein the first joint is coupled to the horizontally stationary member and the second joint is coupled both to the cam follower and to the wafer carrier door receiver so as to allow horizontal movement of the wafer carrier door receiver relative to the horizontally stationary member.

11. A method of opening a sealed wafer carrier, the method comprising:

elevating a wafer carrier door receiver assembly;

impacting a vertical motion stop with a portion of the wafer carrier door receiver assembly, thereby limiting the vertical motion of a portion of the wafer carrier door receiver assembly;

continuing elevating a remaining portion of the wafer carrier door receiver assembly, and translating the continued elevation of the remaining portion of the wafer carrier door receiver assembly into horizontal motion of at least a door receiving

portion of the vertically limited portion of the wafer carrier door receiver assembly.

5 12. The method of claim 11 wherein impacting a vertical motion stop with a portion of the wafer carrier door receiver assembly thereby limiting the vertical motion of a portion of the wafer carrier door receiver assembly comprises:

10 placing a vertical motion stop adjacent the wafer carrier door receiver assembly wherein the wafer carrier door receiver assembly comprises a door receiving portion, a horizontally stationary member, a cam follower coupled to the door receiving portion and to the horizontally stationary member; and

15 impacting a vertical motion stop with the cam follower thereby limiting the vertical motion of the door receiving portion and the cam follower.

20 13. The method of claim 11 wherein translating the continued elevation of the remaining portion of the wafer carrier door receiver assembly into horizontal motion of at least a door receiving portion of the vertically limited portion of the wafer carrier door receiver assembly comprises:

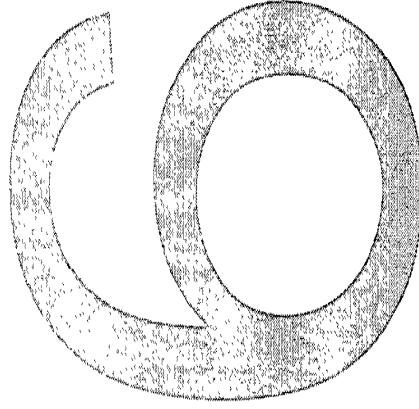
25 linking at least a door receiving portion of the vertically limited portion of the wafer carrier door receiver assembly with the remaining portion of the wafer carrier door receiver assembly that continues to be elevated.

14. The method of claim 11 further comprising:
counterbalancing the downward gravitational
force of at least a door receiving portion of the wafer
carrier door receiver assembly.

15. A system adapted to receive a sealed wafer
carrier and to open the sealed wafer carrier, the system
comprising:
the wafer carrier opener of claim 1; and
a wafer carrier platform, adapted to receive
a sealed wafer carrier, operatively coupled to the wafer
carrier opener of claim 1.

16. A system adapted to process a wafer
comprising:
a wafer carrier loading station having the
wafer carrier opener of claim 1; and
a processing tool, coupled to the wafer
carrier loading station, having at least one processing
chamber.

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| (71) | Applicant (for all designated States except US): APPLIED MATERIALS, INC. | IUS/US/1; 3050 Bowers Avenue, Santa Clara, CA 95054 (US). | |

Published:

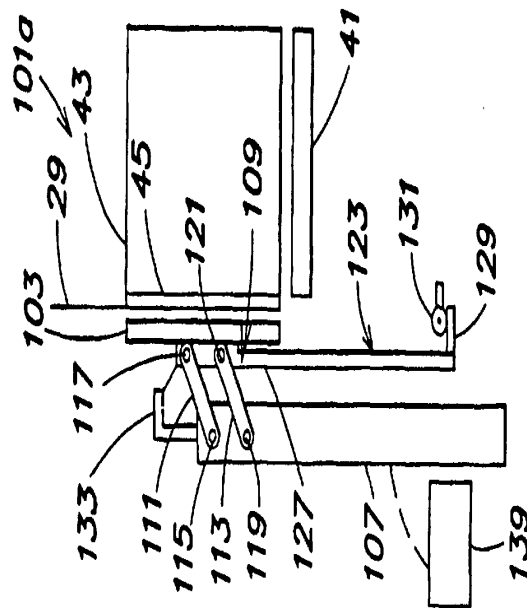
without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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(54) Title: AUTOMATIC DOOR OPENER



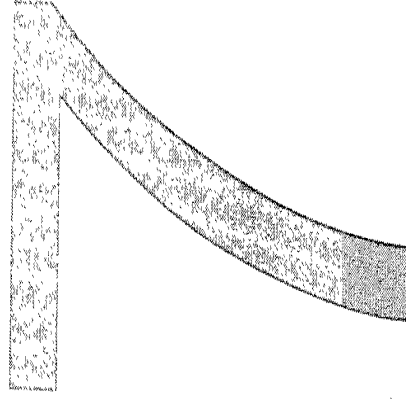
(57) Abstract: A wafer carrier opener is provided. The wafer carrier opener may eliminate the use of two separate actuators by using a four-bar linkage mechanism. The wafer carrier opener includes a wafer carrier door receiver, a horizontally stationary member, and a link coupled between the wafer carrier door receiver and the horizontally stationary member so as to allow horizontal movement of the wafer carrier door receiver.

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Drawings



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FIG. 1
(PRIOR ART)

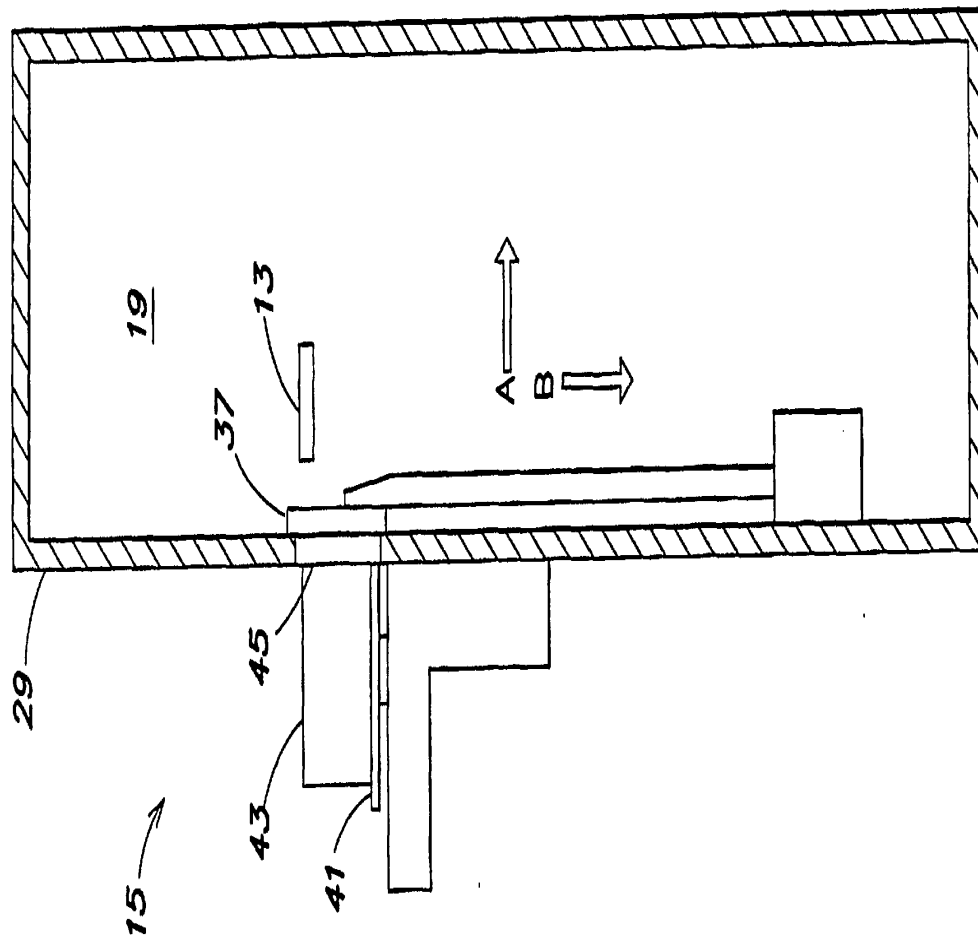


FIG. 2A
(PRIOR ART)

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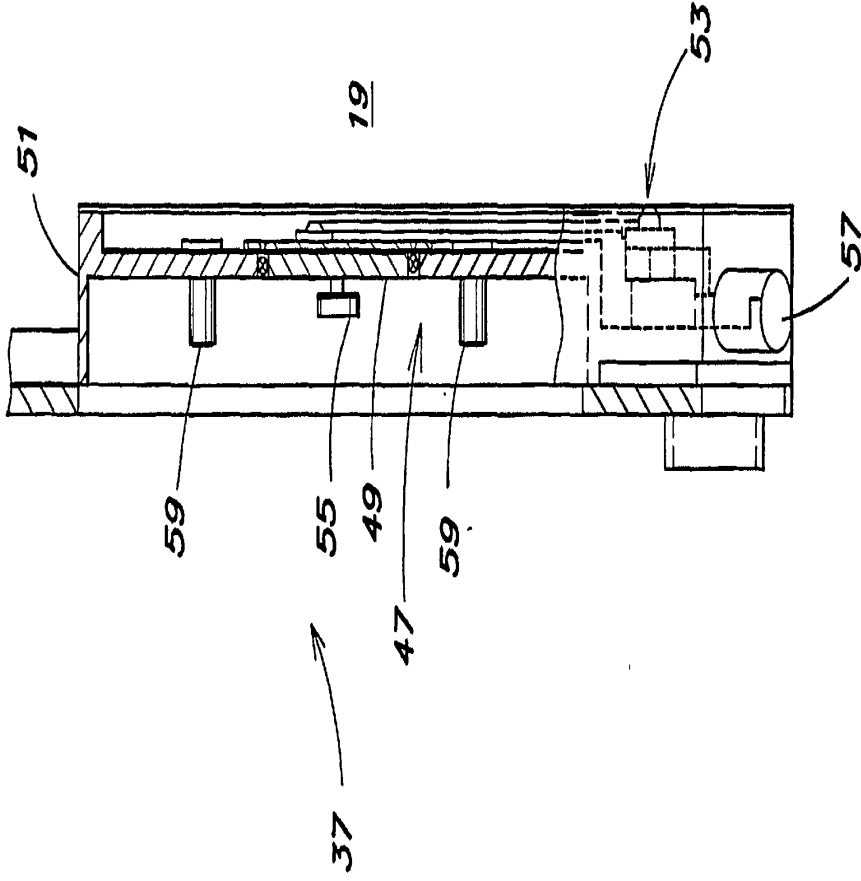


FIG. 2B
(PRIOR ART)

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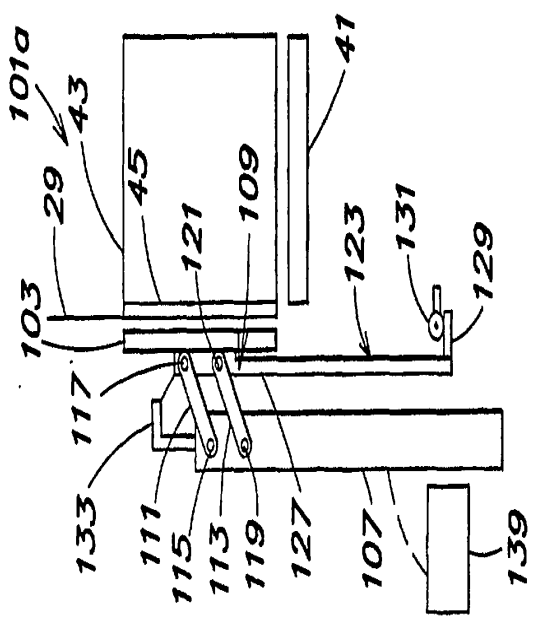


FIG. 3A

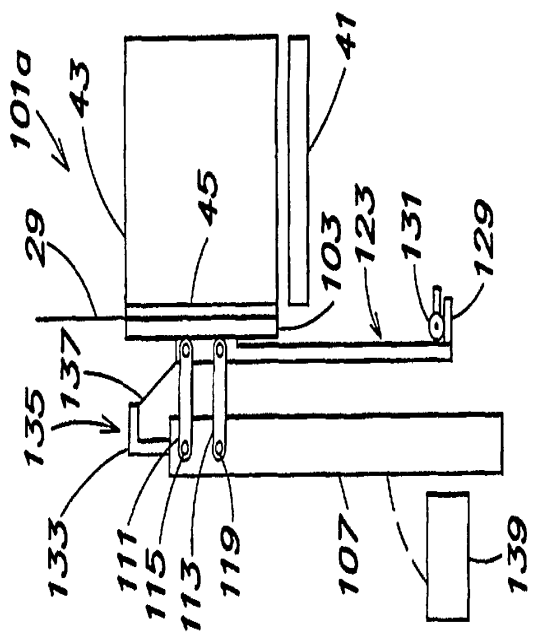


FIG. 3B

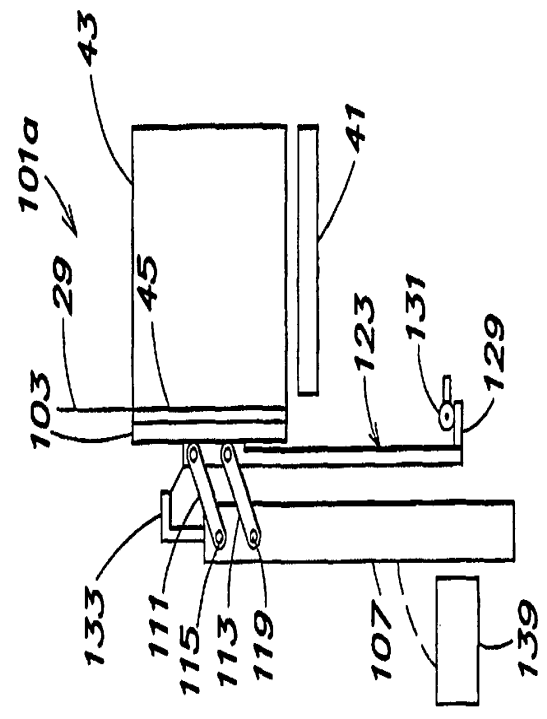


FIG. 3C

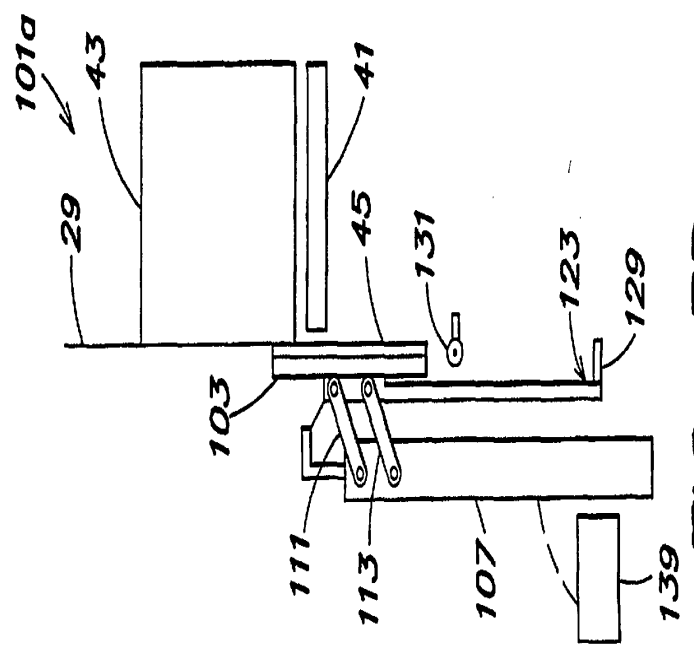


FIG. 3D

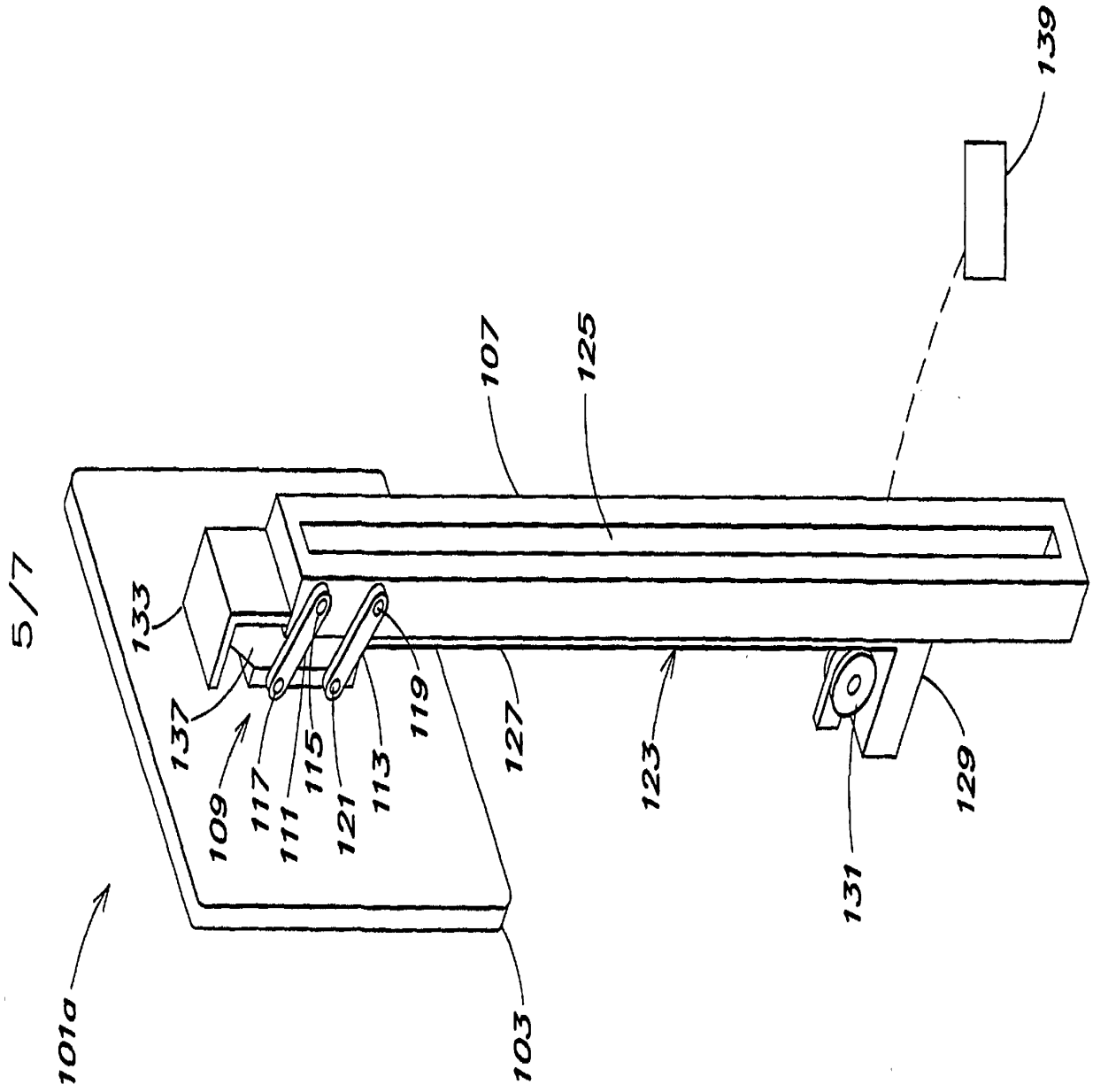


FIG. 4

FIG. 5C

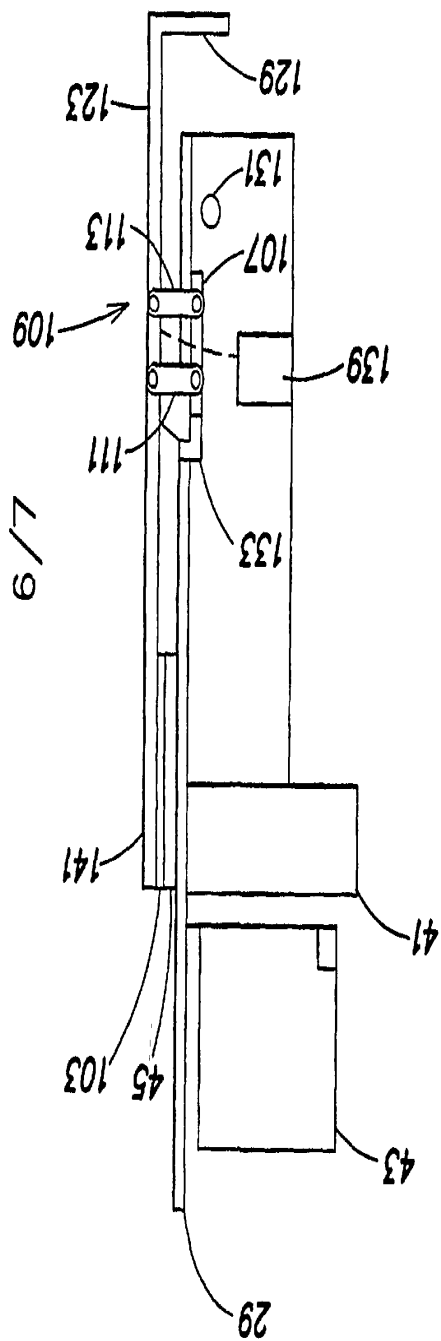


FIG. 5B

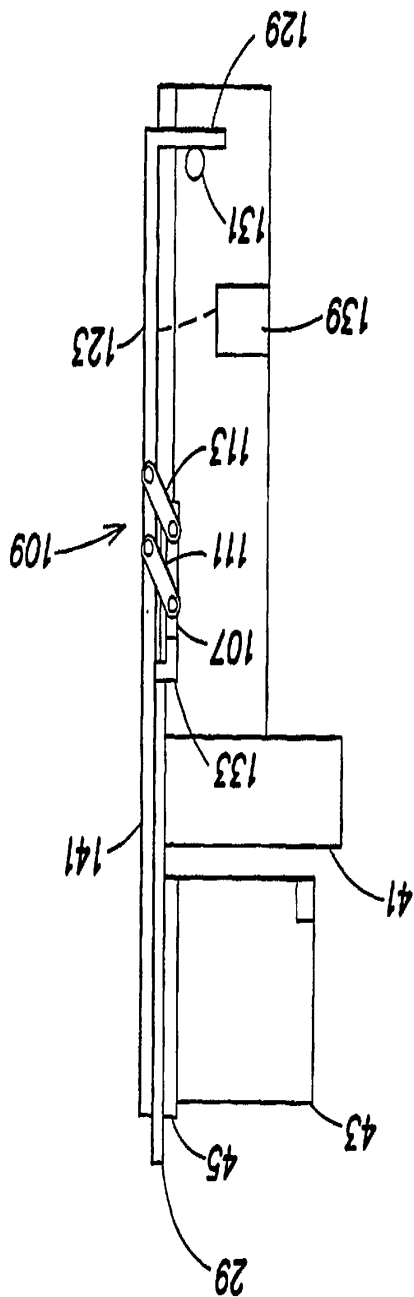
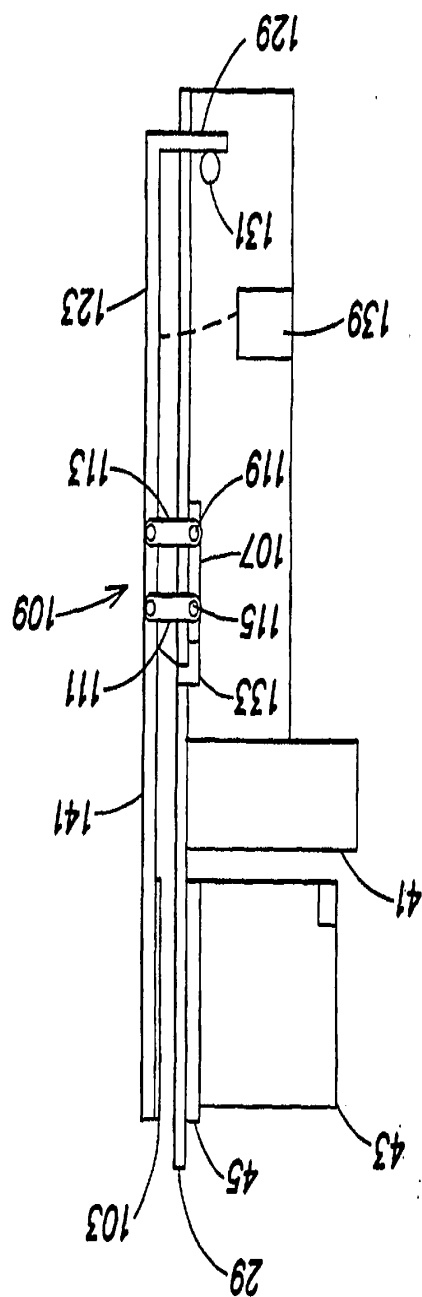


FIG. 5A



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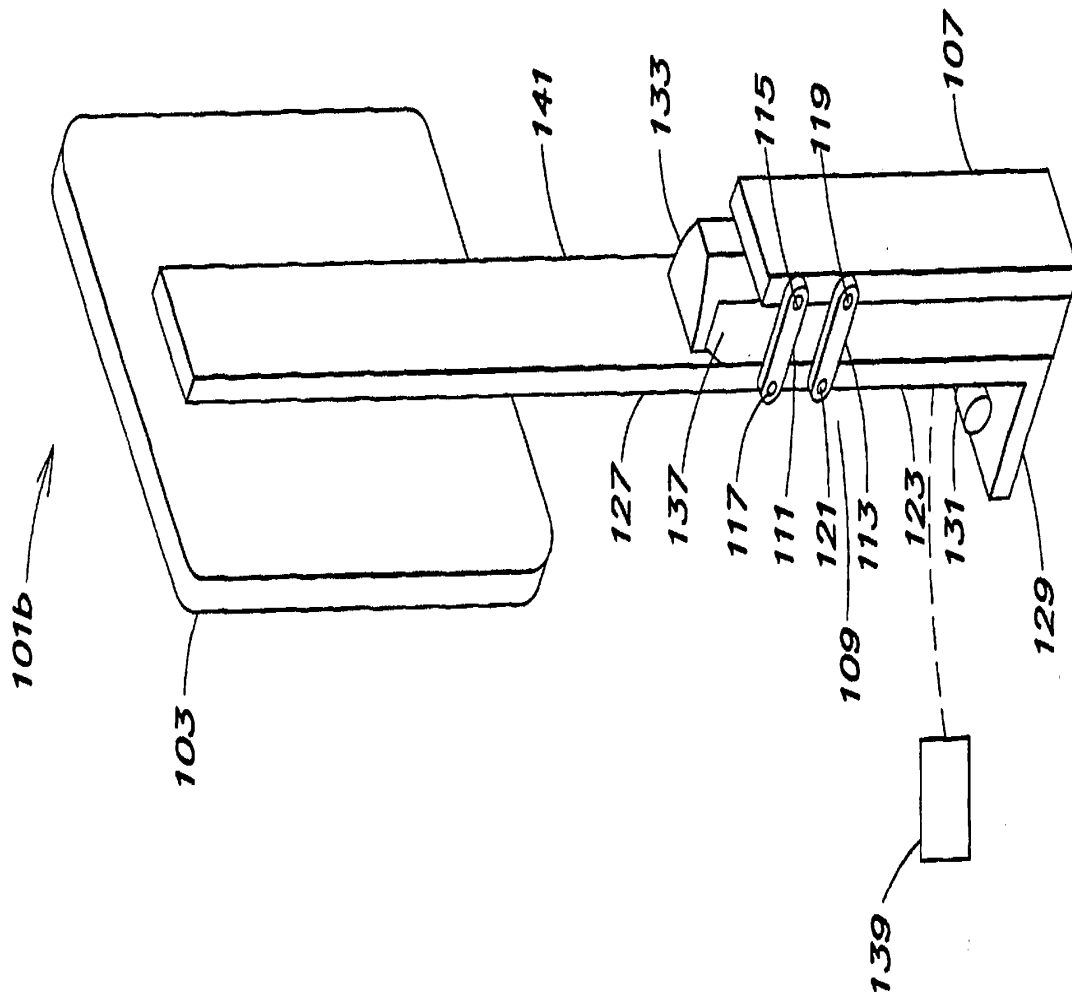


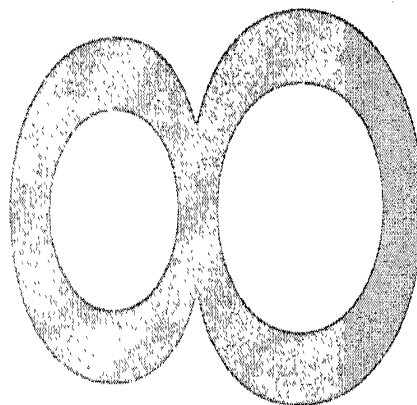
FIG. 6

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COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

This declaration is of the following type:

- ☒ original
☐ divisional
☐ continuation
☐ continuation-in-part

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

AUTOMATIC DOOR OPENER

SPECIFICATION IDENTIFICATION

The specification of which:

- ☐ is attached hereto
☐ was filed _____, under Serial No. _____, executed on even date
herewith; or
☐ Express Mail No. _____ (if applicable) (as Serial No. not yet known) and was amended on
_____ was described and claimed in PCT International Application No. PCT/US01/41237 filed on June
30, 2001.
☒

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information I know to be material to patentability in accordance with Title 37, Code of Federal Regulations, 1.56,

and which is material to the examination of this application; namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

- ☐ In compliance with this duty there is attached an Information Disclosure Statement in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. §119)

I hereby claim foreign priority benefits under Title 35, United States Code, §119, of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than

the United States of America or of any United States Provisional Application(s) listed below, and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

☐ No such applications have been filed.
☒ Such applications have been filed as follows:

A. Prior foreign/PCT/provisional application(s) filed within 12 mos. (6 mos. for design) prior to this application, and any priority claims under 35 U.S.C. § 119

<u>Country/PCT</u>	<u>Application No</u>	<u>Date Filed</u>	<u>Priority Claimed</u>
US	60/217,147	July 7, 2000	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No

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Country:
 Application No:
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I hereby claim the benefit under Title 35, United States Code, § 120, of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information that is material to the examination of this application (namely, information where there is substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

☒ No such applications have been filed
☐ Such applications have been filed, as follows:

<u>Serial No.</u>	<u>Filing Date</u>	<u>Patent Pending</u>	<u>Status</u>
			Abandoned

POWER OF ATTORNEY

I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

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(Declaration ends with this page)